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The Growth of Philippine Children

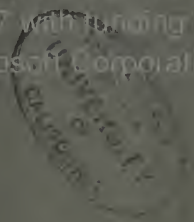
BY

JOHN FRANKLIN BOBBITT

Formerly Instructor in the Philippine Normal School

A THESIS SUBMITTED TO THE FACULTY OF CLARK
UNIVERSITY, WORCESTER, MASS., IN PARTIAL
FULFILMENT OF THE REQUIREMENTS FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY, AND ACCEPTED
ON THE RECOMMENDATION OF G. STANLEY HALL

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THE GROWTH OF PHILIPPINE CHILDREN¹

JOHN FRANKLIN BOBBITT

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Child study to date has occupied itself almost exclusively with children of the white races, and anthropology has been concerned chiefly with adults. Both of these fields of research have become widely extended, but neither has yet seriously undertaken the study of the children of the various colored races. This remains an almost untouched field. If one wishes to obtain exact data with reference to the physical or mental capabilities of the children of any race other than the white, there is scarcely a study to which one can refer with confidence. In the writings of travellers, explorers, teachers, and missionaries, one finds numerous opinions as to the children. Anthropologists have in many cases made a few measurements and tests upon children, perhaps a half dozen in a tribe. The opinions, however, are too casual and conflicting, and the measurements too few and inexact as to age and other conditions, to be of great service in estimating either the physical or the mental efficiency of the children observed. The chief exceptions are a few studies made by the Japanese, and the recently-published elaborate study of Ales Hrdlicka upon the Indians of the Southwestern United States and Northern Mexico.

To take a concrete case illustrative of our uncertainty in this field, it is usually assumed and frequently asserted that the children of the Tropics develop more rapidly and mature earlier than the children of colder lands. It is at present difficult either to prove or to disprove the statement, owing to the dearth of exact statistical data.

¹Special acknowledgments are due Dr. David P. Barrows, Director of Education, and Mr. G. W. Beattie, Supt. of the Philippine Normal School, for aid and encouragement in the work. Without their help this study could not have been carried through to its present proportions. Thanks are due also to Miss Jessie L. Durham, Supervisor of the Iondo Schools; to Mr. Guy V. Clinton, and Mr. F. R. Lutz, principals of intermediate schools; to Mrs. John Eagan, Supervisor of the Philippine Normal Training School; and to Dr. Helen T. Woolley, who aided in verifying the ages of the students. J. F. B.

The question arose, however, in a very practical way, in the Philippine Islands, in connection with the formulation of courses of study for the schools. In attempting to fit the stages of instruction to the stages of normal growth, the questions naturally arose as to what the normal growth-stages are, at what age each appears, and how long each continues, in the case of the Malay children of the Philippines.

Such questions were of practical importance. If the periods of development of Philippine children are fore-shortened, then the courses of instruction should be correspondingly fore-shortened; but if, on the other hand, their growth is as slow as that of European children, then for equal results they probably require courses of instruction of equal length.

In answer to the questions, there were no figures to which to appeal, and one could obtain from the teaching profession any sort of opinion that one might be looking for. The only method of finding out was to measure the children. This was undertaken, and the present study presents certain anthropometric evidence as to the rates and stages of their physical growth. This was naturally the first step to be taken even where the facts aimed at were the stages of mental growth and the age of mental maturity.

The children measured were students in various Manila schools,—the Philippine Normal School, Tondo primary schools, Tondo Secondary School, Sampaloc primary schools, and the Sampaloc Intermediate School. In the Philippine Normal School, about three-fourths of the students measured were from the provinces outside of Manila, chiefly those of southern and central Luzon. In the two intermediate schools, about half were from the provinces; and in the primary schools a considerable proportion were born outside of Manila. About all of the Christian provinces were represented; but the major portion of the students measured were Tagalog, Pangasinan, and Ilocano.

One cannot say that the students measured were all of pure Malay blood, so widespread is the infusion of Spanish and Chinese blood in the archipelago. The most that can be said is that they were typical Filipinos, fair representatives of the Christian population of the archipelago. Measurements made on students that admitted themselves to be mestizos, or that gave unmistakable evidence in their appearance of the possession of Spanish or Chinese blood were discarded.

Besides determining growth-stages, a further aim of the study was to make a comparison of Philippine children with those of Europe or America in size and efficiency. In order that results might be entirely comparable, it was necessary to duplicate the methods and apparatus of some previous study

made on white children. Literature on the subject was exceedingly scarce in Manila, but I succeeded in finding a report of Director Smedley's work in the Child-Study Laboratory in Chicago, for the year 1899-1900, as published in the report of the Commissioner of Education for 1902. His study appeared to be a careful one, and both his methods and his apparatus were described in detail, verbally and graphically. In order to obtain entirely comparable results, therefore, I duplicated his apparatus and used his methods. These are not here repeated since they can be found in his report.

The measurements taken were: (1) Height; (2) Span of arms; (3) Sitting height; (4) Weight; (5) Vital capacity; (6) Grip of right and left hands. Span of arms was not measured by Mr. Smedley, but comparable measures were found in Porter's study on St. Louis children. One of the most significant of Mr. Smedley's measurements, that of endurance as given by the ergograph, had to be omitted for lack of a duplicate instrument. This omission was unfortunate since, as may be seen later in this study, one is led to expect some rather surprising and perhaps quite favorable results. It is to be hoped that some one will be moved to carry through this portion of the study in the not distant future.

The measurements on each child were recorded on an individual card,—yellow cards being used for boys, and white for girls, to prevent any possibility of mixing data of the two sexes. On each card were also taken the child's name, date of birth, date of measurement, his age, name of the church where he had been baptized in order that the date of birth might be verified, native province, and the race of his father and mother.

One serious difficulty met with was obtaining the ages of the children. In a tropical climate, there is so little to mark the passage of time that the conception of a year is not at all well defined in the children's minds. They easily fail to keep track of their ages. Great effort had therefore to be made to obtain the true age. Of pupils born in the city of Manila, we verified the ages from the baptismal records in the churches. Also the ages given by a pupil to his teachers at different times were compared, and if he had given his age consistently for three or four times, it was considered evidence of correctness, but when he had given contradictory ages at different times, his statements had to be inquired into before his age could be determined. We impressed upon pupils the desirability of getting correct ages, and asked them to inquire of their parents so as to make no mistake. They are an extremely obliging people and they took an interest in the work; so I have reason to believe that we obtained the true age in most cases. It re-

mains a source of some error, however, especially in the case of the younger pupils. In the case of students fourteen years old and over there is perhaps only very slight error in the matter of age. In verifying the ages of the younger pupils in the churches, it was found that when the age was given wrong, it varied upward from the true age about as often as downward, so that even if these errors had not been eliminated, they would not greatly have affected the median values. The errors that yet remain uneliminated are undoubtedly of this fluctuating sort, not seriously affecting median or average values where the number of pupils measured is considerable.

After rejecting those of questionable age and the mestizo class—those with some Spanish or Chinese blood—records remain of 1,180 boys and 438 girls from 6 to 21 years of age. The numbers are large enough to show the approximate curves of growth, though, especially in the upper and lower age-extremes, the numbers are too few for exactness. This is clearly indicated by the irregular angular nature of some of the curves, particularly those for girls where the numbers are far fewer than in the case of boys. Still it is believed that a greater number of observations would do little more than to smooth out the irregularities. The pupils measured were typical of their class.

The results of the measurements are shown in the following tables in the forms of medians, averages, variabilities, and yearly

Mean Measurements of Philippine Boys

Age	Number Cases	Stature	Span of Arms	Height Sitting	Weight	Grip Right	Grip Left	Vital Capacity
		Mm:	Mm:	Mm:	Kilos:	Kilos:	Kilos:	Cc:
6	6	1096	1050	605	18.0	12.0	11.5	950
7	18	1135	1120	620	18.8	15.2	14.2	1010
8	32	1170	1156	648	20.3	16.5	15.7	1130
9	41	1210	1188	664	21.3	17.4	16.8	1210
10	70	1247	1237	673	23.0	19.0	18.0	1290
11	63	1299	1298	698	25.8	21.2	19.6	1400
12	94	1360	1365	720	28.4	22.9	21.4	1570
13	87	1403	1423	741	31.1	25.0	23.8	1810
14	96	1471	1493	771	35.1	27.7	25.8	1950
15	130	1542	1581	812	41.4	35.1	31.8	2280
16	131	1582	1618	842	45.4	38.5	36.8	2570
17	145	1605	1649	851	47.0	41.0	37.9	2810
18	97	1609	1664	855	48.9	43.1	39.7	2860
19	68	1620	1674	862	51.2	44.1	42.9	2970
20	54	1622	1678	866	51.6	44.4	41.5	3070
21-5	48	1610	1666	861	51.3	43.5	40.0	3000

increments. If errors of age are entirely of a fluctuating character, it is possible that the medians may be less affected by this form of error than the averages. The differences, however, between the two are not great. The curves of growth shown in the charts are, with the exception of those dealing

Mean Measurements of Philippine Girls

Age	Number Cases	Stature	Span of Arms	Height Sitting	Weight	Grip Right	Grip Left	Vital Capacity
		Mm:	Mm:	Mm:	Kilos:	Kilos:	Kilos:	Cc:
7	4	1145	1115	620	19.0	13.0	12.0	1130
8	9	1175	1165	638	20.3	15.2	14.2	1130
9	15	1232	1235	657	22.8	18.1	16.8	1210
10	17	1273	1252	668	23.2	18.0	17.1	1260
11	27	1305	1293	690	26.5	20.5	18.6	1300
12	33	1381	1378	722	29.8	22.4	21.1	1510
13	24	1425	1430	758	33.5	26.2	24.5	1610
14	32	1455	1470	772	36.5	26.6	25.4	1740
15	68	1480	1506	788	40.0	29.5	27.3	1970
16	52	1488	1500	798	41.6	29.6	27.6	2000
17	54	1500	1534	803	43.4	30.3	28.3	2200
18	40	1495	1523	806	44.0	31.0	28.3	2100
19	27	1498	1523	810	42.8	30.5	28.0	2200
20-5	26	1486	1510	803	42.5	30.3	27.0	2030

Averages and Variabilities of Philippine Boys

Age	Height					Weight				
	Number Cases	Average	Standard Deviation	Annual Increment	% of Increment	Number Cases	Average	Standard Deviation	Annual Increment	% of Increment
		Mm:	Mm:	Mm:			Kilos:			
7	18	1148	47			18	18.9	2.1		
8	32	1191	63	43	3.7	31	20.8	2.8	1.9	10.1
9	41	1211	59	20	1.7	40	21.8	3.0	1.0	4.8
10	70	1252	40	41	3.4	70	23.4	2.1	1.6	7.3
11	63	1309	55	57	4.6	63	26.2	3.5	2.8	12.0
12	94	1366	78	57	4.4	94	29.5	5.4	3.3	12.6
13	89	1408	69	42	3.1	89	32.4	4.7	2.9	9.8
14	96	1461	81	53	3.8	96	35.9	6.2	3.5	10.8
15	130	1541	69	80	5.5	132	41.5	5.7	5.6	15.6
16	131	1585	52	46	3.0	131	45.9	5.0	4.4	10.6
17	145	1602	56	17	1.1	146	47.5	5.1	1.6	3.5
18	97	1612	56	10	0.6	97	49.8	5.4	2.3	4.8
19	68	1626	45	14	0.8	67	52.4	5.7	2.6	5.2
20	54	1622	52			51	51.7	5.1		
21-5	48	1621	54			47	51.7	4.9		

with annual increments, based upon median values. Curves based upon averages follow the same general lines; the differences are but slight.

All measurements are in terms of metric units. Age is that of the last birthday. Children called ten years of age in

Age	Span of Arms					Height Sitting				
	Number Cases	Average	Standard Deviation	Annual Increment	% of Increment	Number Cases	Average	Standard Deviation	Annual Increment	% of Increment
		Mm:	Mm:				Mm:	Mm:		
7	18	1128	58			18	623	21		
8	31	1169	69	41	3.6	31	647	30	24	3.8
9	41	1198	70	29	2.5	41	661	31	14	2.2
10	70	1244	49	46	3.8	70	673	21	12	1.8
11	62	1299	62	55	4.4	63	699	24	26	3.9
12	94	1371	86	72	5.5	94	719	40	20	2.9
13	89	1425	85	54	3.9	89	745	41	26	3.6
14	96	1480	93	55	3.9	96	770	49	25	3.4
15	131	1579	72	99	6.7	132	812	36	42	5.5
16	131	1621	63	42	2.6	131	841	32	29	3.6
17	145	1646	73	25	1.5	146	851	27	10	1.2
18	96	1656	68	10	0.6	97	859	29	8	0.9
19	63	1680	57	24	1.4	67	862	26	3	0.4
20	54	1676	56			51	866	22	4	0.5
21-5	48	1667	62			39	866	24		

Age	Grip of Right Hand					Grip of Left Hand					Vital Capacity				
	Number	Average	σ	Ann. Inc.	% Inc.	Average	σ	Ann. Inc.	% Inc.		Average	σ	Ann. Inc.	% Inc.	
		Kg.				Kg.					Lit.				
7	18	14.8	2.6			14.1	2.3				1.02	.14			
8	31	17.0	3.2	2.2	14.9	15.7	3.2	1.6	10.4		1.14	.18	.12		11.8
9	40	17.6	3.0	0.6	3.5	16.8	2.6	1.1	7.0		1.22	.19	.08		7.4
10	70	18.9	2.1	1.3	7.4	18.0	2.5	1.2	7.1		1.31	.23	.09		7.0
11	63	21.3	3.5	2.4	12.7	19.9	3.2	1.9	10.6		1.50	.23	.19		14.5
12	92	23.9	5.2	2.6	12.2	22.4	4.8	2.5	12.6		1.62	.32	.12		8.0
13	89	25.8	4.6	1.9	8.0	24.4	4.3	2.0	8.9		1.80	.32	.18		11.1
14	93	28.2	6.1	2.4	9.3	26.4	5.7	2.0	8.2		1.98	.41	.18		10.0
15	132	35.1	7.5	6.9	24.5	32.3	7.1	5.9	22.4		2.35	.43	.37		18.7
16	130	38.8	6.5	3.7	10.6	36.6	6.1	4.3	13.3		2.59	.39	.24		10.2
17	143	41.7	6.4	2.9	7.5	38.6	6.4	2.0	5.5		1.80	.37	.21		8.1
18	95	43.5	7.2	1.8	4.3	40.5	7.2	1.9	4.9		2.91	.44	.11		3.9
19	67	44.6	7.2	1.1	2.5	42.1	6.9	1.6	4.0		3.01	.43	.10		3.4
20	50	45.6	7.3	1.0	2.2	42.7	6.7	0.6	1.4		3.06	.35	.05		1.7
21-5	39	43.5	5.9			40.0	5.5				2.97	.27			

the tables are therefore of all ages from ten to eleven, or on an average of about ten and a half years. It is believed that the usual error of this assumption as pointed out by Dr. Boas does not exist in the case of Philippine children, or at least did not when these measurements were made. The schools had been only recently established, the pupils were very indifferently graded, and classes were organized irrespective of age.

Averages and Variabilities of Philippine Girls

Age	Height					Weight				
	Number Cases	Average	Standard Deviation	Annual Increment	% of Increment	Number Cases	Average	Standard Deviation	Annual Increment	% of Increment
		Mm:	Mm:	Mm:			Kilos:			
7	4	1135	51			4	18.8	2.2		
8	9	1178	56	43	3.8	9	20.5	2.4	1.7	9.0
9	15	1228	54	50	4.2	15	22.7	2.8	2.2	10.8
10	17	1268	61	40	3.3	17	24.0	3.6	1.3	5.7
11	27	1295	57	27	2.1	27	26.6	3.6	2.6	10.8
12	33	1370	69	75	5.8	33	30.1	4.4	3.5	13.2
13	24	1428	51	58	4.2	24	35.0	6.1	4.9	16.3
14	42	1454	46	26	1.8	42	36.5	5.4	1.5	4.3
15	68	1480	52	26	1.8	68	40.3	4.7	3.8	10.4
16	52	1485	55	5	0.3	52	42.2	5.5	1.9	4.7
17	54	1503	51	18	1.2	54	44.5	6.8	2.3	5.5
18	40	1504	51	1	0.1	40	44.0	4.5		
19	27	1488	43			27	43.6	4.6		
20-5	26	1497	61			26	44.0	6.9		

Age	Span of Arms					Sitting Height				
	Number Cases	Average	Standard Deviation	Annual Increment	% of Increment	Number Cases	Average	Standard Deviation	Annual Increment	% of Increment
		Mm:	Mm:	Mm:			Mm:	Mm:	Mm:	
7	4	1103	64			4	615	32		
8	9	1160	64	57	5.2	9	643	39	28	4.6
9	15	1218	54	58	5.0	15	656	27	13	2.0
10	17	1235	80	35	2.9	17	677	26	21	3.2
11	27	1295	68	42	3.4	27	688	30	11	1.6
12	33	1380	76	85	6.5	33	723	38	35	5.1
13	24	1441	60	61	4.4	24	756	29	33	4.6
14	42	1461	57	20	1.4	42	770	33	14	1.9
15	68	1499	61	38	2.6	68	788	30	18	2.3
16	52	1505	71	6	0.4	52	795	27	7	0.9
17	54	1521	58	16	1.1	54	807	28	12	1.5
18	38	1514	54			40	808	28	1	0.1
19	27	1519	51			27	801	27		
20-5	26	1515	61			26	799	36		

Age	Grip of Right Hand					Grip of Left Hand					Vital Capacity			
	Number	Average	σ	Ann. Inc.	% Inc.	Average	σ	Ann. Inc.	% Inc.	Average	σ	Ann. Inc.	% Inc.	
		Kg:				Kg:				Lit.				
7	4	12.5	2.5			12.3	2.9			1.00	.16			
8	9	15.0	2.3	2.5	20.0	14.5	2.0	2.2	17.9	1.10	.17	.10	10.0	
9	15	18.0	3.0	3.0	20.0	16.7	3.6	2.2	15.2	1.20	.14	.10	9.1	
10	17	18.3	3.2	0.3	1.7	17.1	3.1	0.4	2.4	1.28	.16	.08	6.7	
11	27	19.9	3.3	1.6	8.7	19.0	3.1	1.9	11.1	1.33	.21	.05	3.9	
12	33	22.0	4.0	2.1	10.6	20.9	3.6	1.9	10.0	1.52	.21	.19	14.3	
13	24	25.7	3.8	3.7	16.8	24.0	3.0	3.1	14.8	1.62	.22	.10	6.6	
14	43	25.7	4.8	0.0	0.0	24.3	4.4	0.3	1.3	1.76	.30	.14	8.6	
15	68	29.2	4.4	3.5	13.6	27.0	4.4	2.7	11.1	1.99	.29	.23	13.1	
16	52	29.9	3.4	0.7	2.4	27.6	3.6	0.6	2.2	2.02	.31	.03	1.5	
17	54	30.7	4.1	0.8	2.7	28.2	4.5	0.6	2.2	2.15	.31	.13	6.4	
18	40	30.3	4.1			28.5	4.4	0.3	1.1	2.13	.26			
19	27	30.3	4.3			27.9	4.6			2.18	.21			
20-5	26	30.6	4.7			27.4	4.2			2.03	.34			

GROWTH-STAGES

Height. As in all studies made upon European and American children, there appear to be three clearly marked stages of growth in Philippine children: (1) The steady growth of childhood; (2) The accelerated growth of puberty; (3) The diminishing growth of the post-pubertal period.

The accelerated growth of puberty occurs in Philippine boys between the ages of thirteen and sixteen, with the greatest annual increment from fourteen to fifteen; in girls, between eleven and fourteen years, with the greatest annual increment from eleven to twelve. The acceleration begins and ends two years earlier with girls than with boys; the greatest annual increment, however, comes three years earlier with girls than with boys, coming in the earlier part of the pubescent growth of girls and in the later portion of that of boys.

After sixteen, boys grow slowly for four years more, growth extending to the age of twenty. Growth after seventeen is very slight, however, amounting to not more than two centimeters. The average of the 838 adult Filipinos measured by Dr. Folkmar, if his anthropometric measurements can be relied upon, is on an exact level with that of the 145 seventeen-year-old boys recorded in this study. This does not mean that Filipinos cease to grow at seventeen. It perhaps rather indicates slight differences in the samples of the population measured. The adults measured by Dr. Folkmar were inmates of Bilibid prison. He selected his 838 individuals out of a possible 3,000. It is possible that he rejected more of the mestizo

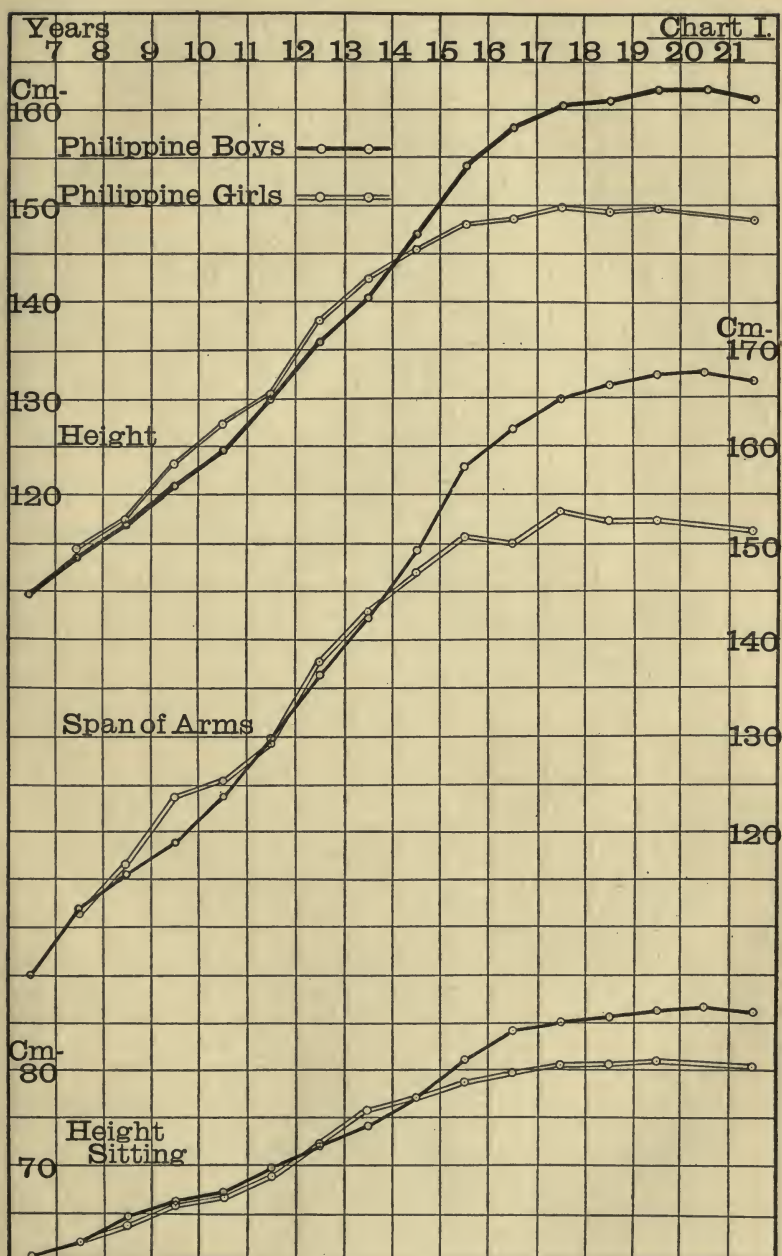


CHART I. Absolute Growth of Philippine Boys and Girls.

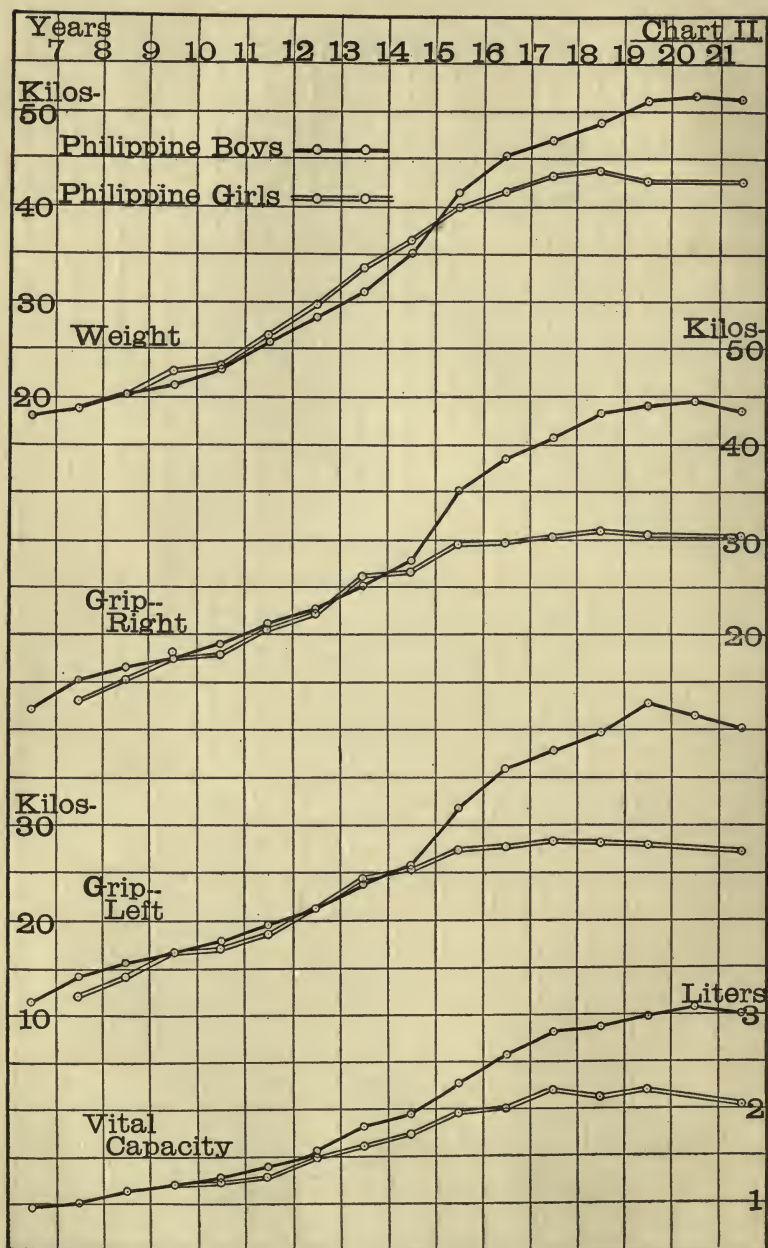


CHART II. Absolute growth of Philippine Boys and Girls.

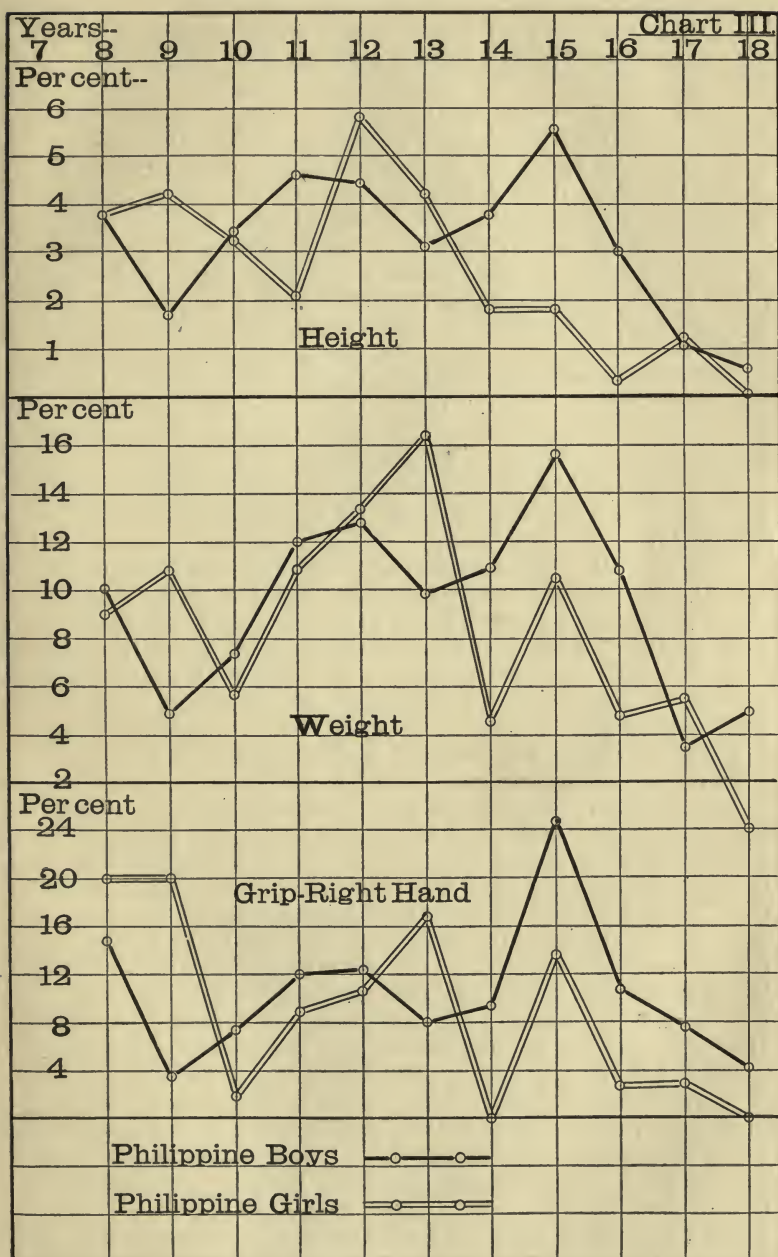


CHART III. Yearly Increments of Growth in Percents.

class than could be done in the case of our students, the marks of Spanish blood not being so evident in children; and also that the penal class were slightly under normal. On the other hand, our Manila schools, perhaps, contain a slightly larger proportion of mestizo blood than does the population in general. Yet after allowance is made for these things, the evidence is to the effect that Philippine boys on an average grow in height but little after seventeen years of age.

Philippine girls after the age of fourteen grow in height for three years more, or until the age of seventeen. At this age their height appears to be complete. In this respect, girls appear to attain complete maturity at least three years before boys.

As with Europeans, Philippine girls are taller than boys from eleven to fourteen. In the girls measured, height was greater than that of boys at all ages before fourteen, which differs from the studies on Europeans.

The stages of growth in absolute height for both boys and girls are shown graphically in Chart I; annual increments in Chart-III.

Span of arms. The growth of the span of arms from finger-tip to finger-tip very nearly parallels that of stature, indicating the same stages of growth at the same ages. Girls again are slightly superior to boys until fourteen, after which they fall behind. Span of arms at the age of eight is about 98.5% of the stature for both boys and girls; at the age of twenty, it is about 103% of the stature with boys, and 102% with girls.

Curves of absolute growth are found on Chart I, of span of arms relative to stature on Charts VI and X.

Height Sitting. Since this is a measurement in one dimension of the vital organs of trunk and head, the limbs being totally excluded, it is, perhaps, a more significant measurement than stature or span of arms. In the curves of growth in sitting height given on Chart I, the three stages of growth are very clearly shown. In the growth of boys, these stages correspond exactly with those of stature; with girls, however, the post-pubertal growth appears to extend up to nineteen, or two years longer than in the case of stature. Although slight after seventeen, it is sufficient to be significant. The steady growth of boys from seventeen to twenty is more clearly shown than in the case of stature. In this dimension, girls are shorter than boys until twelve, taller between twelve and fourteen, and then again falling behind after fourteen. That girls should surpass boys in both stature and span of arms at all ages before twelve, but fall behind them in sitting height for the same period, seems to indicate a relatively greater length of limb in girls for this period. In the later post-pubertal period, this relation is reversed.

The relation of sitting height to stature is shown in Charts VI and X.

Weight. Weight was taken with clothing, but tropical clothing is very light in weight.

The stages of the growth in weight are synchronous in all important respects with growth in stature. Girls are absolutely heavier than boys from eight to fifteen. In relation to height, weight remains at all ages about equal for the two sexes, inclining slightly in favor of girls in the later adolescent period, as shown in the charts.

The adults of all ages measured by Dr. Folkmar were on an average three pounds heavier than the twenty-year adolescents measured in this study, yet the adults averaged two centimeters less in height. Taking both facts into consideration, we are led to believe that the weight of these twenty-year-old youths was not complete, and that growth in weight continues for some time after twenty. Like all peoples, they tend to fill out somewhat after maturity in height is reached.

Muscular Strength. Grip of right and left hands was taken by means of Smedley's adjustable dynamometer, manufactured by C. H. Stoelting & Co., of Chicago. The instrument was occasionally tested for accuracy as to the dial readings. In making the tests the distance between the bars was adjusted to the size of the pupil's hand, and he was permitted several trials, the best one being recorded.

The results as shown graphically in Chart II show boys and girls to be of about equal strength until the age of fourteen. After this age, the divergence is very striking, girls increasing in strength of grip less than four kilos, while boys increased about seventeen. In the individuals measured, girls reach their maximum at eighteen, and boys at twenty. One cannot be sure that growth in strength is complete at these ages, however, since the later measurements are too few, and the individuals of too special a class for the later results to be entirely trustworthy in this respect.

Growth in the strength of the left hand parallels that of the right at all stages in both sexes. Strength of the left hand differs from that of the right by from five to ten per cent. This difference, as in white children, is as great in girls as in boys, as shown in the tables, and in Charts VII and XI.

It is interesting to notice that boys of seven will grip eighty per cent. of their weight, and youths of eighteen, eighty-eight per cent. Girls of seven will grip seventy per cent. of their weight, and at eighteen the same. In relation to weight, the amount of strength that both boys and girls can put forth in a single muscular effort is surprisingly great, much greater indeed than that of the well-conditioned boys and girls

measured by Mr. Smedley. Whether the endurance of Filipinos is commensurate with their strength as shown in a single effort, or whether one is at the expense of the other is a question that cannot be answered until some one has undertaken a study of their muscular endurance.

Another interesting fact in this connection is the relatively great strength of Philippine girls as compared with Philippine boys. Dr. Christopher and Mr. Smedley show that among American children measured at Chicago "boys surpass the girls in strength at all ages; even in the kindergarten the average boy is stronger in his left hand than the average girl is in her right hand." This is not true of Philippine girls before the age of thirteen. At thirteen their strength is equal absolutely to that of boys, if not slightly greater; and from nine to fourteen the differences of the averages are very slight, in no case more than a single kilo.

Vital Capacity. Vital capacity was taken by means of a wet spirometer. Each pupil was permitted several attempts, and the best mark attained was recorded. Before nine years boys and girls show no appreciable difference in breathing capacity. From nine to twelve, boys slightly surpass girls. After twelve, the divergence increases, the difference becoming marked after fifteen. In this respect only do Philippine boys of thirteen surpass girls of the same age. This difference may be partly or even wholly due to the conditions of the test. Boys were more ready to lay aside their dignity and blow with sustained effort than were the girls; and it is possible that the girls were more hindered by their form of clothing.

General Conclusions. Philippine children show the three marked stages of development between the ages of six and twenty as clearly as do children of European descent; and the periods appear to be synchronous for the two races. The pubertal acceleration usually begins in Philippine boys at twelve or thirteen years and extends up to sixteen or seventeen. After this age growth seems to continue for three or four years longer. Whether or not there is growth after twenty cannot be determined from the data at hand.

With girls the period of pubertal acceleration falls between the ages of eleven and fourteen, arriving and ending some two or three years earlier than with boys. After fourteen, girls continue to grow for three or four years longer, reaching maturity at about seventeen or eighteen. The upper limit is not here indicated with certainty because of the insufficient number measured, and because the girls in the later years of the secondary school constitute a somewhat specialized type.

Philippine girls on an average seem to be about equal to Philippine boys at all ages before fourteen. Anatomically

they are superior to boys between eleven or twelve and fourteen or fifteen; functionally at this period in grip and vital capacity, they are slightly weaker relative to size, but about equal in absolute units. This comparison of boys and girls seems to be of value in indicating a great difference in the physiological age of the two sexes at this chronological period. It seems to show that at thirteen most girls are post-pubescent while most boys of that age remain pre-pubescent, a fact of practical importance in dealing with matters of coeducation recently introduced into Philippine schools.

A COMPARISON OF THE GROWTH OF PHILIPPINE CHILDREN WITH WHITE CHILDREN

A comparison of the children of the two races is best shown graphically, as in the Charts IV to XII. Curves showing the growth of American children are taken from the report of Mr. Smedley's work in the child-study laboratory at Chicago, with the exception of the curves showing annual increments of growth in height and weight which were calculated by Dr. Boas, and may be found in the *American Journal of Psychology*, Vol. IX, No. 3. Since the curves showing the growth of Filipinos were based upon median values, the medians also were employed in constructing the curves for American children. Perhaps averages may just as well have been used since the differences between the two are but slight.

Boys

Height. The curves of growth in height at the top of

Ratio of Height Sitting to Stature

Age	Boys			Girls	
	Filipino	American	Chinese	Filipina	American
7	.544	.560		.540	.550
8	.556	.553		.550	.545
9	.546	.543	.549	.542	.540
10	.536	.534	.552	.528	.534
11	.539	.533	.543	.527	.533
12	.530	.529	.541	.522	.532
13	.529	.517	.540	.532	.527
14	.524	.517	.528	.528	.529
15	.526	.522	.532	.539	.532
16	.532	.527	.521	.537	.535
17	.528	.533		.534	.532
18	.534	.532		.541	.538
19	.531	.527		.541	.538
20	.537	.532		.541	.538

Chart IV show a remarkable parallelism in the growth of Philippine and American boys. Both curves show the same general stages, falling within the same years. The pubertal acceleration falls within the same age-limits for both races. Before the age of fifteen the difference in the height of the two races remains about constant, Filipinos being on an average from six to eight centimeters shorter than Americans of the same ages. But after fifteen, the Philippine boy lags behind. He continues to grow up to twenty, and perhaps even beyond, but his late adolescent growth appears to lack the vigor shown

Ratio of Span of Arms to Stature

Age	Boys			Girls	
	Filipino	American	Chinese	Filipina	American
7	.987	1.003		.974	.995
8	.988	1.008		.992	1.000
9	.984	1.007	.976	1.000	1.000
10	.992	1.010	.985	.985	1.002
11	1.000	1.009	.985	.991	1.008
12	1.004	1.017	.993	.998	1.007
13	1.014	1.015	.986	1.003	1.005
14	1.014	1.018	1.000	1.010	1.012
15	1.025	1.023	1.025	1.018	1.009
16	1.023	1.023	1.030	1.015	1.007
17	1.028	1.021		1.023	1.021
18	1.033	1.029		1.020	1.013
19	1.034			1.017	1.018
20	1.035			1.017	1.001

Ratio of the Cube of Height to Weight

Age	Boys			Girls	
	Filipino	American	Chinese	Filipina	American
7	78.8	74.9		80.1	75.7
8	78.9	76.6		81.0	78.2
9	83.1	78.9	77.2	81.6	79.7
10	84.9	79.8	81.3	88.3	82.3
11	85.2	81.6	79.2	84.8	85.8
12	88.5	81.3	80.9	88.4	84.0
13	88.2	83.6	78.8	87.3	85.7
14	90.5	84.4	82.7	85.3	83.6
15	88.2	84.9	85.2	81.0	81.0
16	86.8	83.9		79.5	78.7
17	88.8	80.3		77.8	80.3
18	85.3	82.6		76.7	78.8
19	83.0	79.9		78.8	78.6
20	82.4	78.7		78.5	78.7

by that of the American boy. As compared with children of North-European descent, Filipinos suffer relative arrest in their physical growth after the age of fifteen. This relative failure of growth-vigor is shown in all the curves of Chart IV. The almost complete parallelism of growth up to fifteen and the subsequent divergence after this age is perhaps most clearly shown in sitting height, which is perhaps the most significant dimension measured.

Chart V shows the greatest annual growth-increment in

Ratio of Strength of Grip to Weight

Age	Boys			Girls	
	Filipino	American	Chinese	Filipina	American
7	.809	.511		.684	.507
8	.813	.532		.749	.505
9	.817	.558	.798	.794	.529
10	.826	.594	.782	.776	.537
11	.822	.612	.838	.774	.544
12	.806	.629	.796	.752	.554
13	.804	.653	.803	.783	.575
14	.790	.677	.773	.729	.566
15	.847	.712	.867	.737	.575
16	.848	.762	.880	.712	.576
17	.873	.772		.698	.589
18	.879	.776		.705	.596
19	.861	.811		.713	.614
20	.861	.815		.768	.623

Relation of Vital Capacity to Weight
Cc. per Kilo

Age	Boys			Girls	
	Filipino	American	Chinese	Filipina	American
7	56.9	54.7		56.4	51.6
8	55.6	55.6		55.7	50.9
9	56.8	55.2	54.7	53.1	51.7
10	55.8	56.0	54.8	54.3	50.9
11	54.3	55.9	54.5	49.0	50.8
12	55.2	55.4	53.7	50.7	47.7
13	58.1	56.7	54.3	48.0	46.9
14	55.6	55.6	55.7	47.7	45.8
15	54.9	55.9	53.1	49.2	45.9
16	56.5	59.5		48.1	45.1
17	59.9	60.6		50.7	46.1
18	58.5	60.4		47.8	46.8
19	57.8	59.4		51.2	48.0
20	59.5	59.3		49.0	48.2

Relation of Strength of Grip to Vital Capacity
Kilos per Liter

Age	Boys			Girls	
	Filipino	American	Chinese	Filipina	American
7	15.1	9.8		12.2	9.6
8	14.6	10.0		13.5	9.7
9	14.4	10.7	14.6	15.0	10.2
10	14.8	10.3	14.3	14.3	10.6
11	15.2	10.6	15.4	15.8	11.1
12	14.6	11.3	14.9	14.9	11.6
13	13.8	11.4	14.8	16.3	12.3
14	14.2	11.4	13.9	15.3	12.4
15	15.4	12.5	16.3	15.0	12.5
16	15.0	12.5	16.1	14.8	12.8
17	14.6	12.8		13.8	12.8
18	15.1	12.9		14.8	12.8
19	14.8	13.6		14.6	12.8
20	14.5	13.7		15.8	13.0

Ratio of Left Hand to Right Hand

Age	Boys			Girls	
	Filipino	American	Chinese	Filipina	American
7	.934	.948		.924	.944
8	.952	.933		.935	.940
9	.966	.942	.975	.928	.935
10	.947	.944	.975	.950	.935
11	.925	.940	.929	.907	.938
12	.935	.920	.971	.942	.940
13	.952	.920	.960	.935	.911
14	.932	.921	.950	.955	.920
15	.906	.929	.901	.926	.925
16	.956	.922		.933	.926
17	.925	.909		.934	.916
18	.921	.918		.913	.933
19	.973	.941		.918	.926
20	.935	.941		.891	.917

height to fall for both races between the ages of fourteen and fifteen. The growth-force during this period seems to be much more pronounced in the Filipino than in the American; but it seems to exhaust itself for him all the more quickly, as shown by the more precipitous fall of the curve after fifteen.

Weight. The curves of weight in Chart IV might seem to indicate that Philippine boys not only fall behind after fifteen, but that they were continually losing ground from the beginning; but such is not the case. The apparent divergence be-

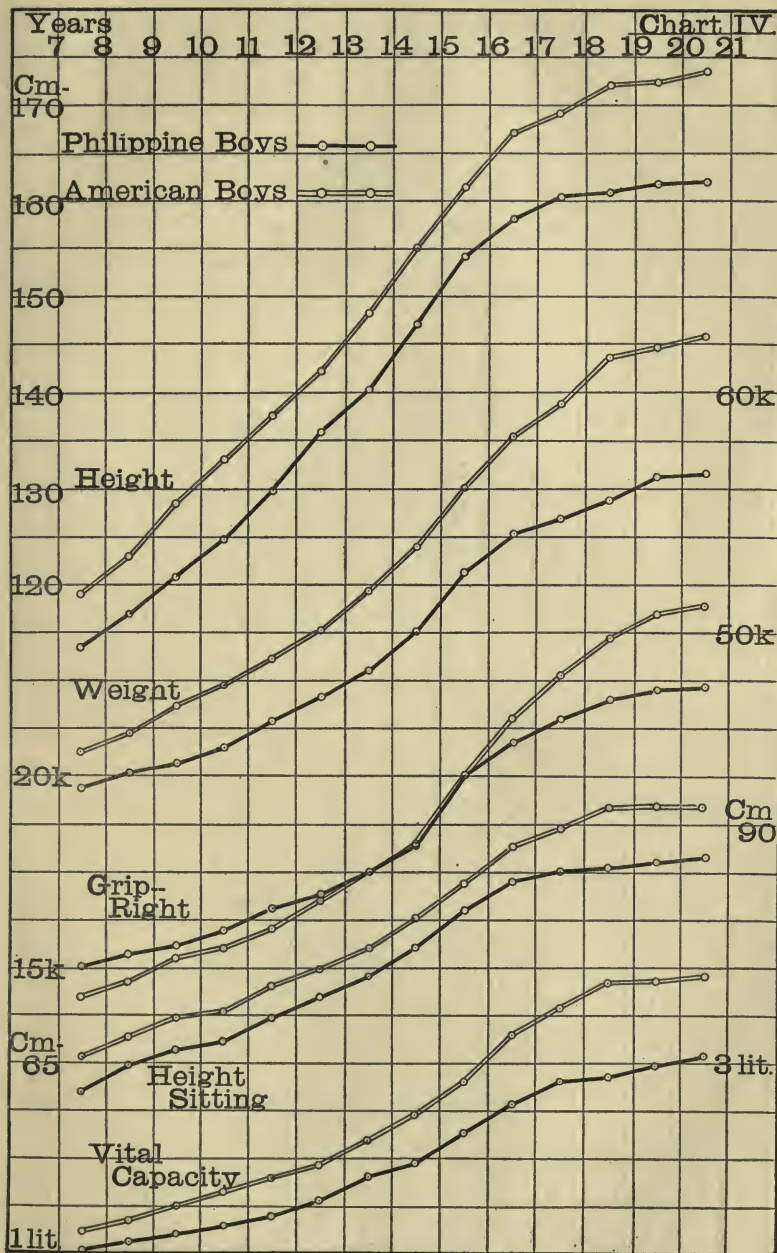


CHART IV. A Comparison of Philippine and American Boys in Absolute Growth.



CHART V. A Comparison of the Annual Increments of Growth of Philippine and American Boys.

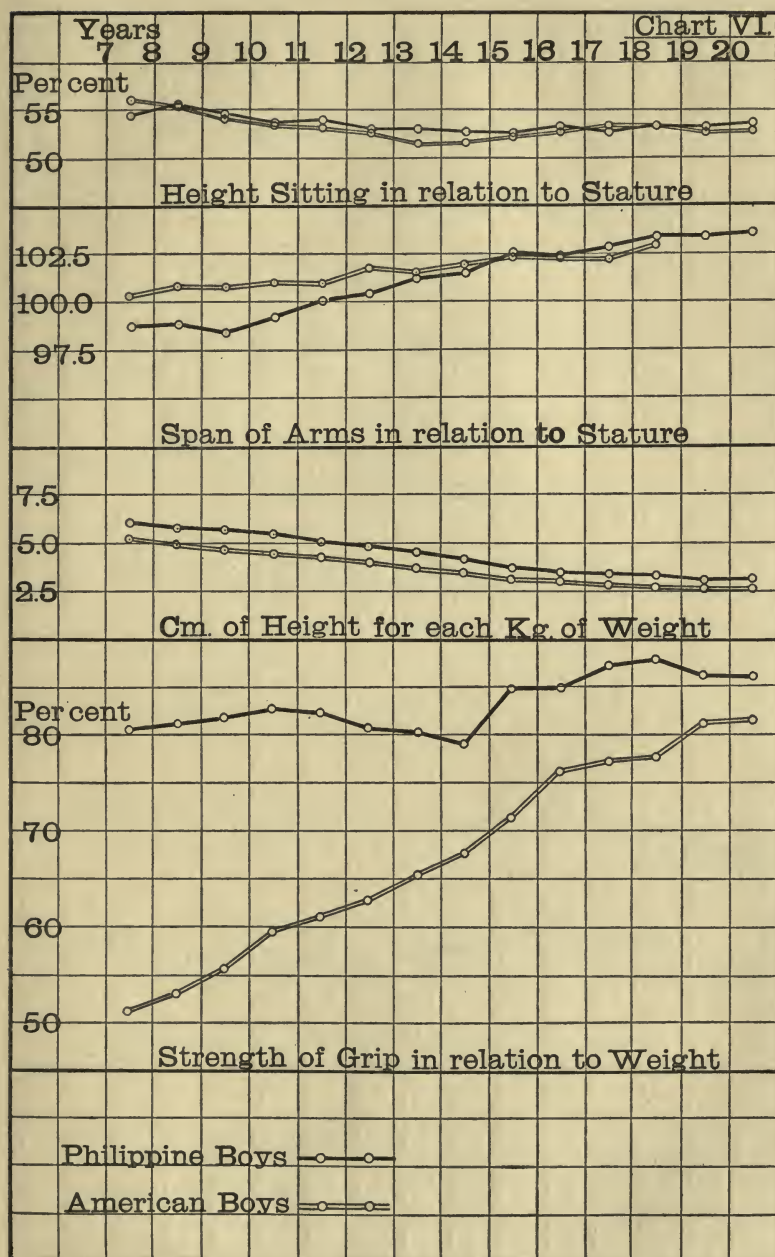


CHART VI. A Comparison of the Relative Growth of Philippine and American Boys.

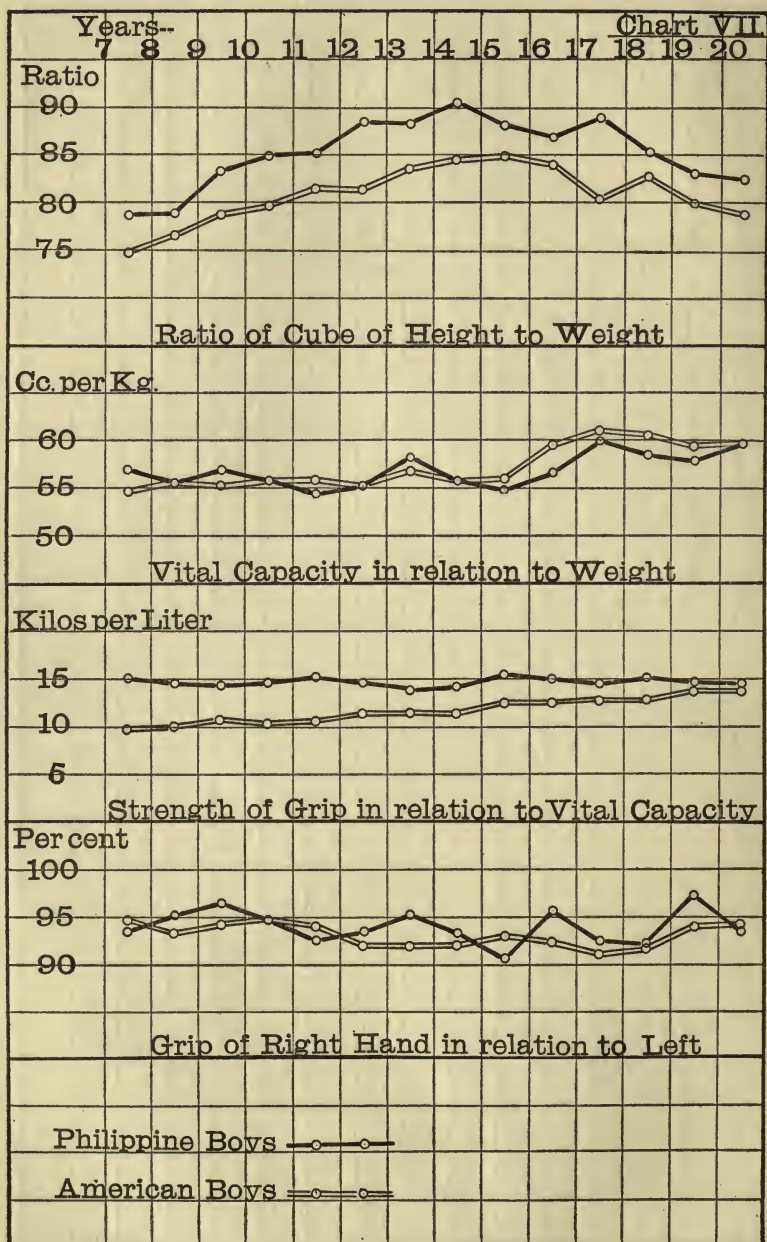


CHART VII. A Comparison of the Relative Growth of Philippine and American Boys.

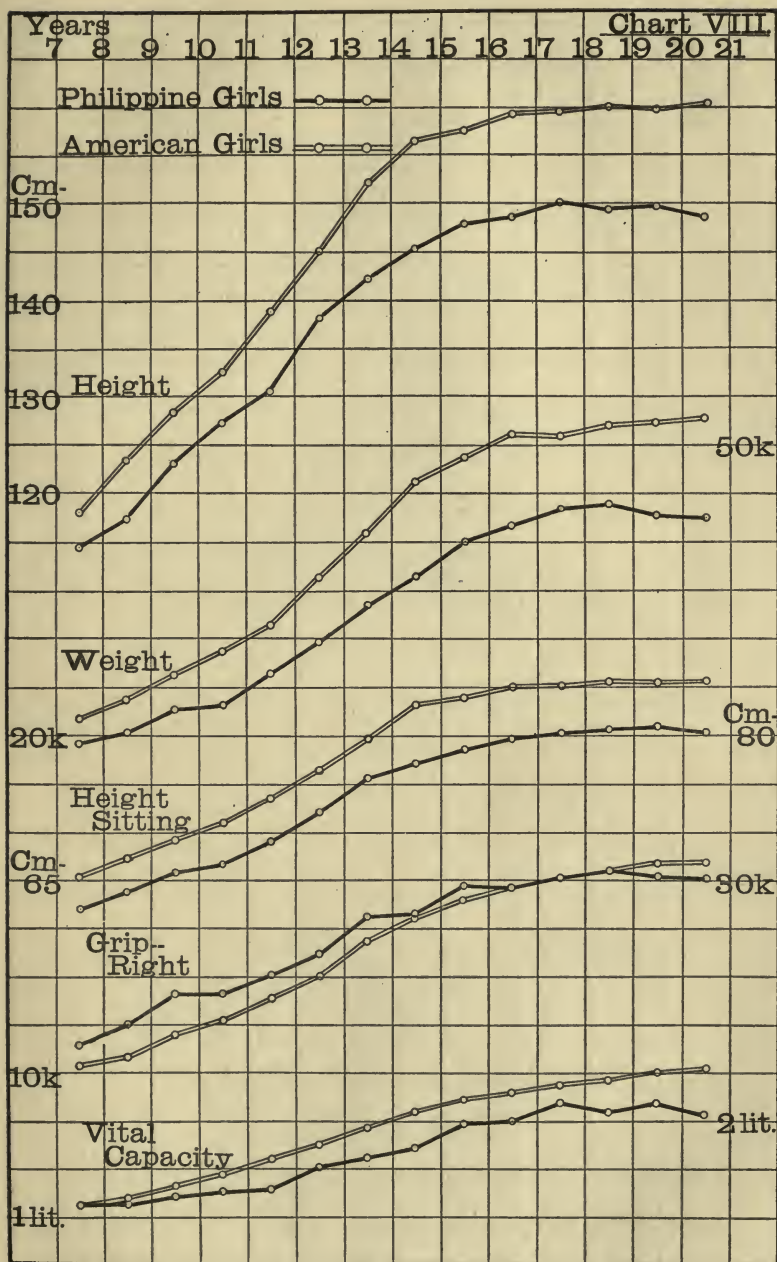


CHART VIII. A Comparison of Philippine and American Girls in Absolute Growth.

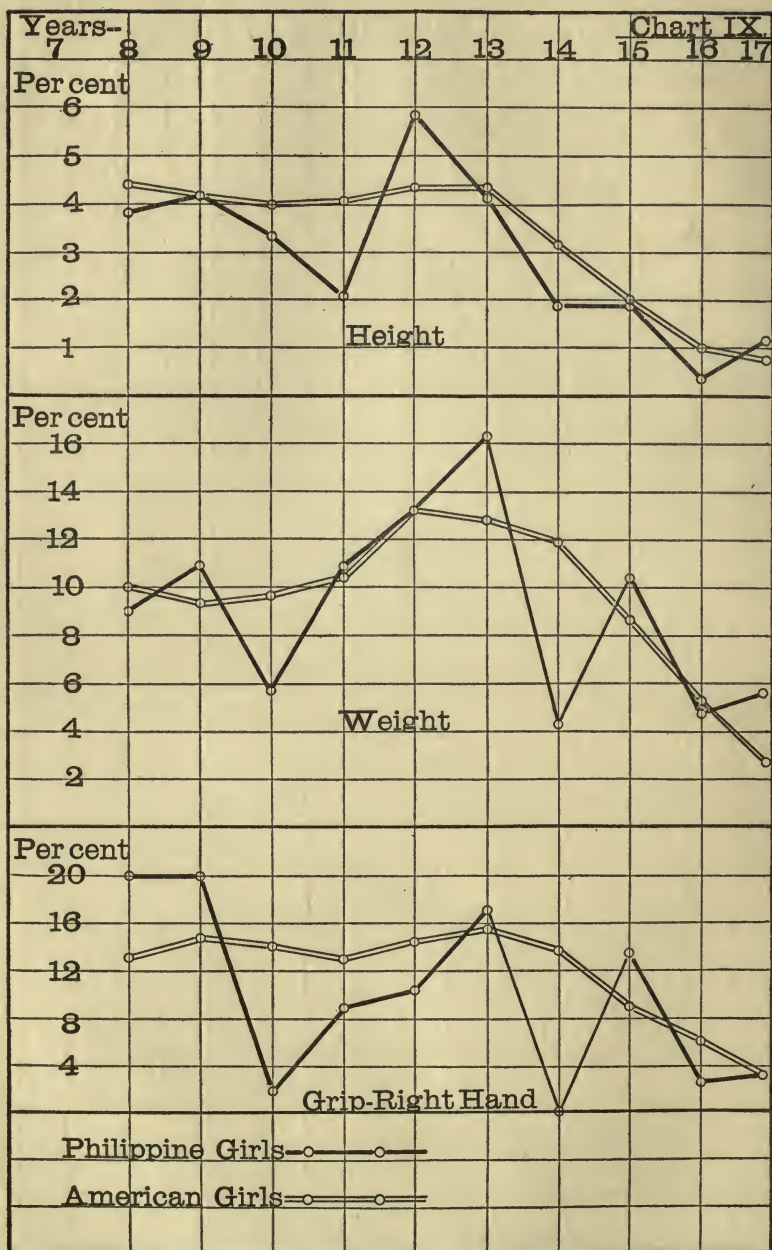


CHART IX. A Comparison of the Annual Increments of Growth of Philippine and American Girls.

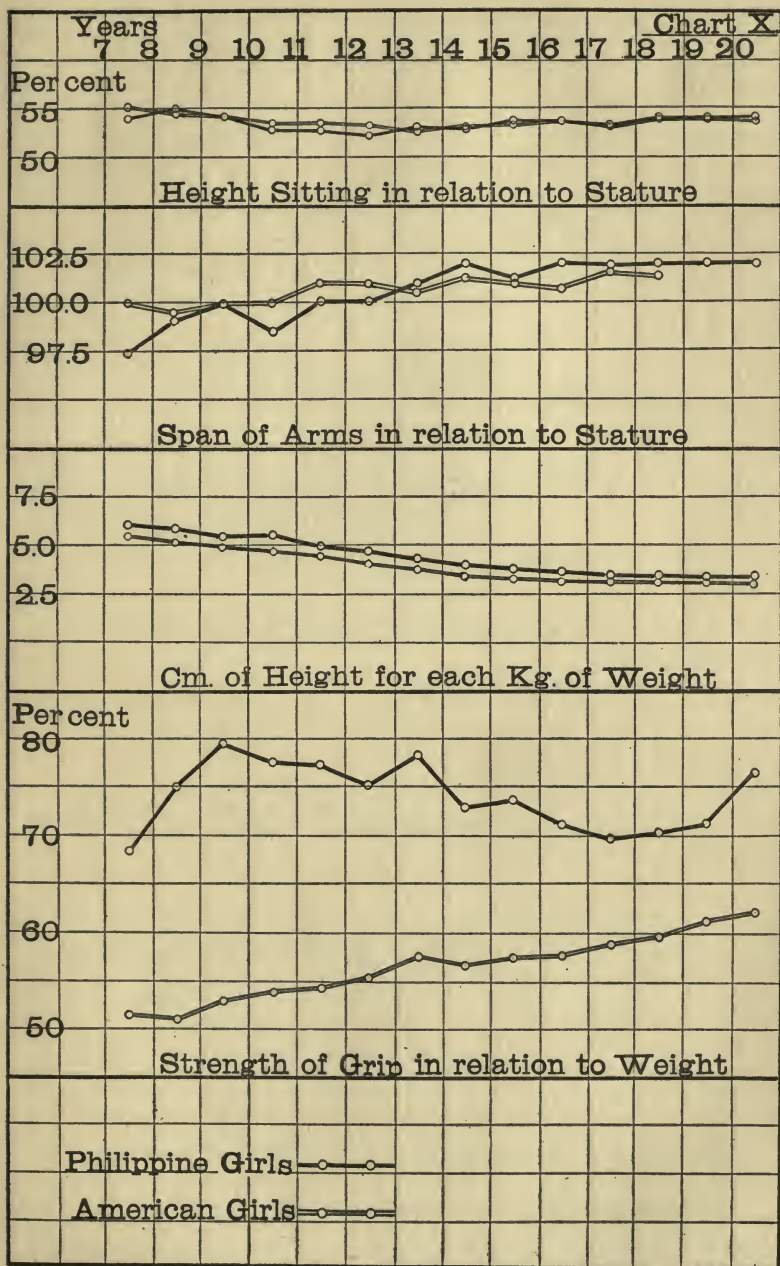


CHART X. A Comparison of the Relative Growth of Philippine and American Girls.

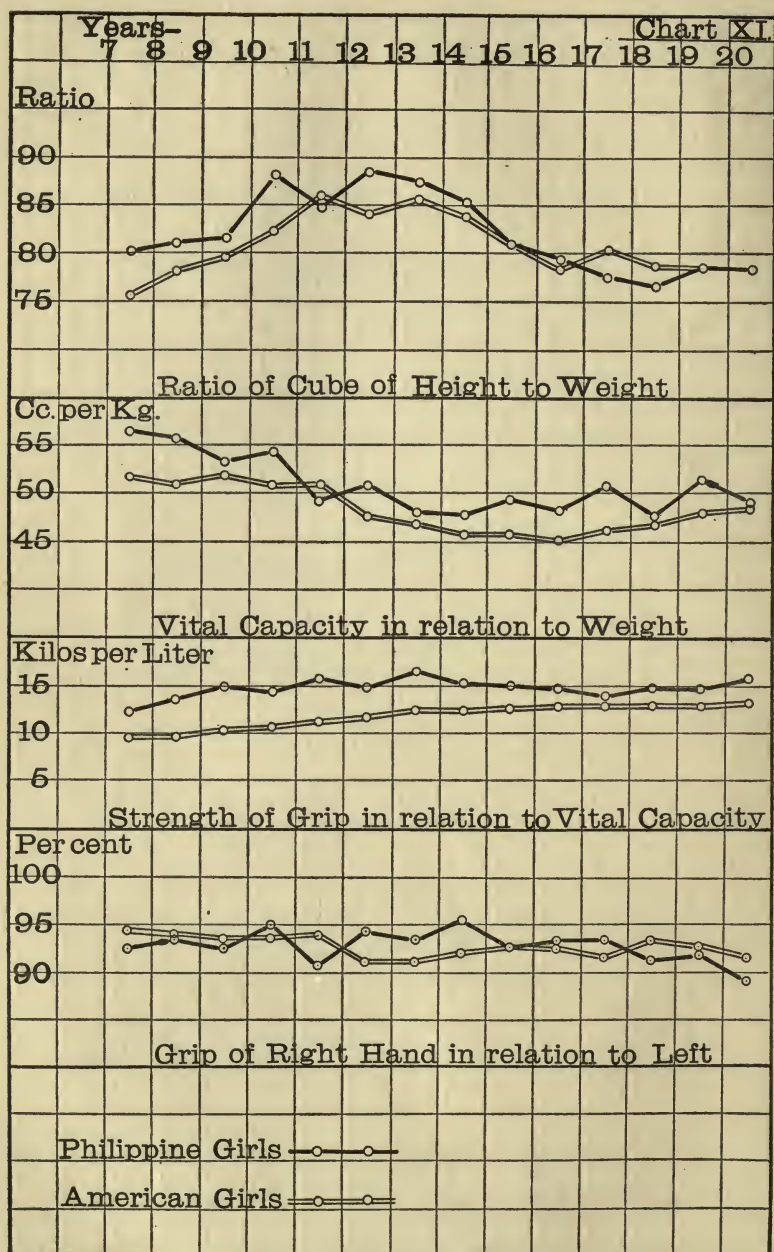


CHART XI. A Comparison of the Relative Growth of Philippine and American Girls.

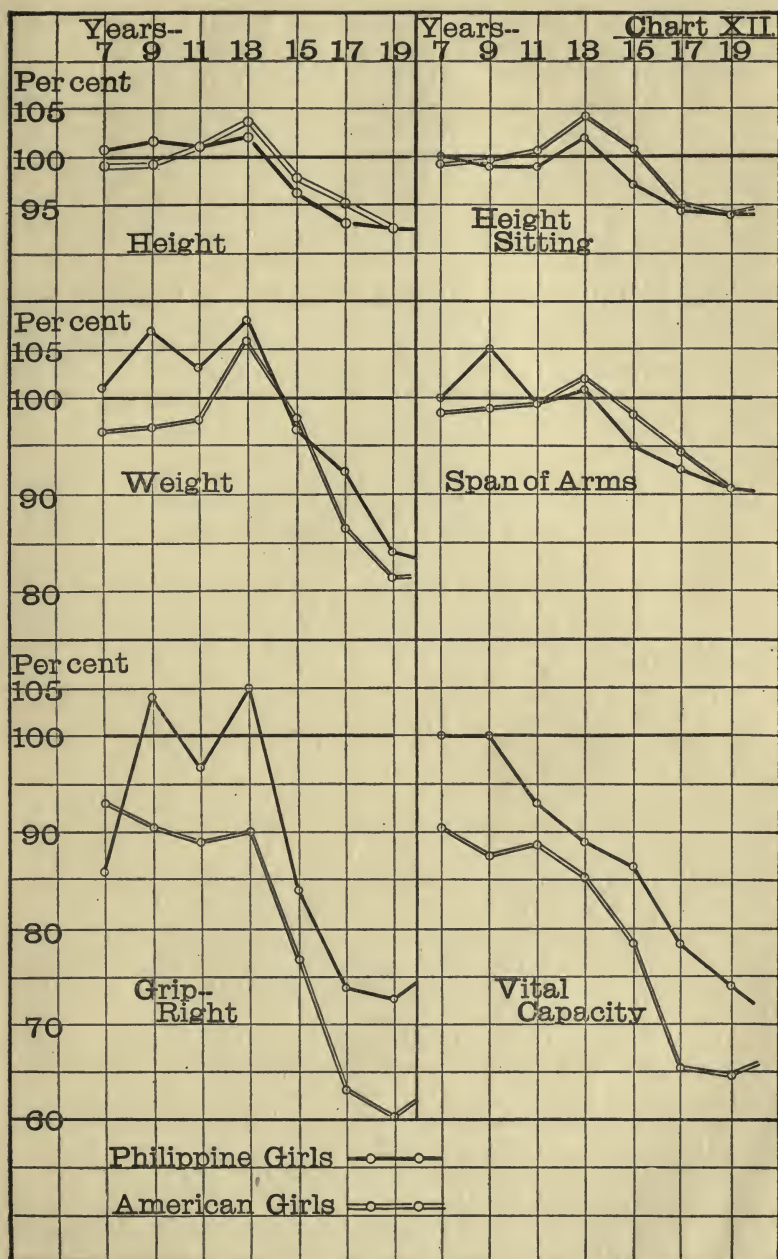


CHART XII. A Comparison of the Growth of the Girls of the two races in their relation to the Boys of their own race.

fore fifteen is due to the difference in height; it must be remembered that weight varies not as the height but rather as the cube of the height. In the tables and in Chart VII is shown the ratio of the cube of the height to the weight at each age for both races. The curves thus formed are parallel throughout, showing that the relation of the two races in weight is the same at all ages as for height. They show also that Philippine boys are at all ages taller relative to their weight; or, stated more simply, Filipinos are more slender than Americans.

Vital Capacity. Vital capacity varies also as the cube of the height, so that the discrepancy here again, although apparent, is not real. The ratio of vital capacity to weight is about the same for both races at all ages, as shown in chart VII. The curves show a great expansion in lung capacity relative to weight for both races between the ages of fifteen and seventeen.

Physical Proportions. Philippine boys are more slender than American boys of corresponding ages. Height sitting in proportion to total stature is about the same for both races, the difference of the averages being at no time more than one per cent. This indicates also that the two races are about equal in relative length of limbs. Span of arms relative to height appears to be from one to two per cent. less for Philippine boys before thirteen; after this age both races are relatively equal.

Strength of Grip. Before the age of thirteen, Philippine boys appear to be superior to American boys of corresponding ages in strength of grip both absolutely and relatively. From thirteen to fifteen, they are equal absolutely, but the Filipinos, being smaller, are relatively superior. After fifteen, Philippine boys fall behind in absolute strength, though retaining their relative superiority, as shown in Chart VI. In calculating strength of grip relative to weight, one must remember that both sets of boys were weighed with clothing, and that American clothing is considerably heavier than the light tropical garments. In the curves, this slight but appreciable difference in weight favors the Filipino; though it will go but a small way in explaining the results.

This difference in the relative strength of grip not being perhaps what one might expect, the conditions of the tests were carefully examined to see that there was no source of error. One's first thought would be that the instruments used may have been dissimilar. But I used a duplicate of Mr. Smedley's instrument, manufactured by the same company. The instrument was tested several times for correctness.

If Philippine pupils had recently been engaged in any form of labor specially adapted to developing the grip, as, for exam-

ple, the pounding of rice in mortars, this would be a disturbing factor; but it is thought this was not the case with the pupils measured to any appreciable degree.

I am unable to discover any important dissimilarity of conditions. If none exists, one must conclude that Philippine boys are, weight for weight, stronger in a single effort of grip than American boys. The left hand as compared with the right is about the same for the two races; the left hand is from five to eight per cent. weaker, the relation varying somewhat with age.

Variabilities. If one compares the variabilities given in the tables with those of Dr. Boas published in the Report of the Commissioner of Education for 1904, one notices that the greatest variability in height and weight occurs at fourteen and fifteen years in both races. This points further to a synchronism in the pubertal expansion of the two races. At this period both races appear to contain a large per cent. of both pre-pubescents and post-pubescents; this is doubtless the meaning of the wide degree of variability.

GIRLS

A comparison of the growth of Philippine and American girls is graphically shown in Charts VIII to XII.

Chart VIII shows the growth of the girls of the two races to be about parallel up to the middle of the pubertal acceleration; after this period, Philippine girls fall behind relatively. Corresponding growth-periods seem to coincide in time for the girls of the two races; and to differ most noticeably in the relative lack of growth-vigor in Philippine girls during later adolescence. This difference is less marked, however, with girls than with boys.

Chart IX shows the greatest growth-increments to fall for both races at twelve or thirteen years. As with boys, the pubertal expansion seems to be more sudden with Philippine than with American girls, and to expend itself more quickly, resulting in a more rapid falling off in the degree of yearly growth after twelve or thirteen.

Charts X and XI show relative physical proportions of the girls of the two races. Height sitting in proportion to stature is the same for both; relative length of limb is the same; arm-span relative to stature differs but slightly. Philippine girls appear to be more slender up to fourteen years of age, after which period the ratio of height to weight appears to be about the same for the two races. Vital capacity relative to weight is distinctly greater for Philippine girls; girls differ in this respect whereas boys were about equal.

In strength of grip Philippine girls appear to be superior to

American girls in absolute strength up to sixteen years, after which they are about equal. In strength relative to weight, Philippine girls seem to be superior at all ages, the difference ranging from ten to twenty-five per cent. Relative strength of the left hand as compared with the right is about the same for the two races.

In Chart XII an attempt has been made to compare the girls of the two races on a basis of their size and strength relative to the boys of their own race. It is claimed that women differ from the men of their own race to a greater degree among some races than among others; the curves were constructed to test this aspect of the matter. In the curves 100 per cent. represents boys; the curves show how much Philippine and American girls rise above or fall below average masculine standards of their race. The results show that in stature, sitting height, and span of arms, the girls of the two races are in this respect about equal, especially as they approach adulthood. In weight, Philippine girls appear to be slightly superior; in strength of grip and in vital capacity Philippine girls are considerably superior,—from five to ten per cent. In other words, the girls of the two races, when their averages are compared with average masculine standards, are structurally about equal; but functionally, in the two aspects measured, Philippine girls are nearer the standards set by the boys of their race than are American girls to American boys. This relation holds for late adolescence; and since the girls of both races seem to be mature by twenty, it doubtless holds true for the adults as well.

CHINESE BOYS

During the course of this study, I measured sixty Chinese boys at the Tondo Chinese School in Manila. Only pure-blood Chinese were measured, Chinese-Filipino mestizos being rejected. Their parents were mostly natives of southern China, —Amoy, Hong-Kong, Canton, Saigon.

I was assured by the principal of the school that they could be depended upon to give their ages correctly; consequently they were taken at their word in the matter of age. But I very much doubt if they gave their ages even so accurately as did the Filipino children.

In this connection one must remember that the Chinese count their ages, not from actual birthdays, but from the Chinese New Year. A ten-year-old Chinese boy is one who has ten times celebrated the Chinese New Year; on an average he is therefore nine and one-half years of age; whereas an American or Filipino boy who says he is ten years old is on an average ten and a half, or a full year older. In the tables, therefore,

I have set back the ages of the Chinese one year so as to make them entirely comparable with the tables for Filipino and American boys.

The following table presents their average measurements.

Averages of Sixty Chinese Boys

Age	Number Cases	Height	Sitting Height	Span of Arms	Weight	Vital Capacity	Grip of Right	Grip of Left
9	4	1237	680	1207	24.7	1350	19.7	19.2
10	7	1275	702	1252	25.2	1380	19.7	19.2
11	11	1286	695	1265	27.0	1470	22.6	21.0
12	9	1348	725	1342	30.4	1630	24.2	23.5
13	14	1390	750	1370	33.6	1770	27.0	25.9
14	10	1442	762	1447	35.1	2010	27.4	26.5
15	5	1585	841	1617	46.3	2450	40.1	36.1

These averages seem to show that in stature, height sitting, and span of arms, Chinese and Filipino boys are not far apart between the ages of nine and fifteen. Curves of growth appear to follow about the same lines up to that age.

In respect to weight, Chinese boys are heavier, both absolutely and relatively. They are not so slender as Filipinos. In absolute strength of grip Chinese appear to be stronger, but relative to weight, they are of about the same strength. The left hand appears to be somewhat more nearly equal to the right in Chinese than in Filipino or American boys.

The sitting height of Chinese boys seems to be somewhat greater than that of Filipinos or whites; or in other words, Chinese appear to have somewhat shorter legs comparatively, with a corresponding gain in the relative volume of vital organs. Span of arms relative to height shows them to have slightly shorter arms also before the age of fourteen.

Since the above was written, I find in "Nature" of Oct. 15, 1908, some results of a far more complete study on the Chinese by Mr. A. H. Crook, Queen's College, Hong Kong. He measured 659 boys and youths between the ages of ten and twenty-four years, and presents an interesting comparison between Chinese and English boys.

A comparison of my results with those of Mr. Crook seems to indicate that Chinese boys of Manila are less developed than those of Hong Kong. Climate may have something to do with the matter; also it is possible that he measured a better class of students at Hong Kong than I found among the shop-keeper's sons in the public schools of Manila.

Mr. Crook remarks on the small amount of chest expansion

in Chinese boys. This was determined by measurements of chest girth. My figures for vital capacity, obtained in an entirely different way, confirm his conclusions.

A COMPARISON OF PHILIPPINE WITH JAPANESE CHILDREN

It appears that the Department of Education in Japan measures the height and weight of all Japanese school children. The average figures for the year 1901 for 869,014 children, as reported by Dr. Misawa in the March number of this *Journal* for the current year (p. 109) are, for boys, as given in the following table. Beside them are the figures for Filipinos and Chinese for comparison.

Age	Height			Weight		
	Filipino	Japanese	Chinese	Filipino	Japanese	Chinese
	Cm.			Kg.		
7	114.8	106.5		18.9	17.6	
8	119.1	111.0		20.8	19.1	
9	121.1	115.6	123.7	21.8	21.1	24.7
10	125.2	120.0	127.5	23.4	22.8	25.2
11	130.9	124.8	128.6	26.2	25.0	27.0
12	136.6	128.7	134.8	29.5	27.0	30.4
13	140.8	133.4	139.0	32.4	29.4	33.6
14	146.1	137.6	144.2	35.9	32.5	35.1
15	154.1	142.1	158.5	41.5	35.2	46.3
16	158.5	146.1		45.9	38.2	

Japanese boys to sixteen years of age are from six to twelve centimeters shorter than Filipino boys of corresponding ages. They are as much shorter than Filipino boys as the latter are shorter than American boys. The table shows the Chinese to be not appreciably different from Filipinos in height. This is one further item of proof that the mongoloid Malays of the Philippines are racially more closely related to the Chinese than to the Japanese.

In weight the same relationship holds.



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